DEPARTMENT OF DEFENSE
ANNUAL REPORT ON CHEMICAL WARFARE AND CHEMICAL/BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS FOR THE PERIOD OCTOBER 1, 1989 THROUGH SEPTEMBER 30, 1990
RCS: DD-USDRE(A) 1065

INDEX

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(Dollars in Thousands)

	ARMY	NAVY	AIR FORCE	TOTAL
Chemical Warfare and Chemical Defense Program	216,186	19,778	13,334	249,298
Biological Defense Program	75,272	0	0	75,272
Total Program	291,458	19,778	13,334	324,570

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There have been no studies conducted within the Department of Defense during the reported period that involved the use of human subjects for testing of chemical or biological agents.

ANNEX A

DEPARTMENT OF THE ARMY

ANNUAL REPORT ON

CHEMICAL WARFARE AND CHEMICAL/BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS

1 OCTOBER 1989 THROUGH 30 SEPTEMBER 1990

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DEPARTMENT OF THE ARMY

ANNUAL REPORT ON

CHEMICAL WARFARE AND CHEMICAL/BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS

SECTION I

OBLIGATION REPORT ON CHEMICAL WARFARE AND CHEMICAL DEFENSE PROGRAM

FOR THE PERIOD 1 OCTOBER 1989 THROUGH 30 SEPTEMBER 1990

DEPARTMENT OF THE ARMY

RCS: DD-USDRE (A) 1065

DESCRIPTION OF RDTE EFFORT FOR THE CHEMICAL WARFARE AND CHEMICAL DEFENSE PROGRAM

During FY 90, the Department of the Army obligated $216,186,000 for general research investigations, development and test of chemical warfare agents, weapons systems and defensive equipment.

FUNDS OBLIGATED

Current Fiscal Year	(CFY)	$201,935,000		
Prior Year	(PY)	14,251,000		
			In-House	$ 73,128,000
TOTAL		$216,186,000	Contract	$143,058,000

Breakdown of Program Areas

1. CHEMICAL RESEARCH

a. Basic Research in Life Sciences	CFY	$ 11,212,000		
	PY	11,000		
			In-House	$ 5,891,000
		$ 11,223,000	Contract	$ 5,332,000
b. General Chemical Investigations Exploratory Development	CFY	$ 4,603,000		
	PY	34,000		
			In-House	$ 3,851,000
		$ 4,637,000	Contract	$ 786,000
TOTAL: CHEMICAL RESEARCH	CFY	$ 15,815,000		
	PY	45,000		
			In-House	$ 9,742,000
		$ 15,860,000	Contract	$ 6,118,000

2.	LETHAL CHEMICAL PROGRAM				
	a. Exploratory Development	CFY	$ 1,080,000		
		PY	-0-		
				In-House	$ 775,000
			$ 1,080,000	Contract	$ 305,000
	b. Advanced Development	CFY	$ 400,000		
		PY	-0-		
				In-House	$ -0-
			$ 400,000	Contract	$ 400,000
	c. Full-scale Development	CFY	$ 34,090,000		
		PY	357,000		
				In-House	$ 230,000
			$ 34,447,000	Contract	$ 34,217,000
	d. Testing		$ -0-		
TOTAL:	LETHAL CHEMICAL PROGRAM	CFY	$ 35,570,000		
		PY	357,000		
				In-House	$ 1,005,000
			$ 35,927,000	Contract	$ 34,922,000
3.	INCAPACITATING CHEMICAL PROGRAM				
	a. Exploratory Development	CFY	$ 2,086,000		
		PY	-0-	In-House	$ 1,908,000
			$ 2,086,000	Contract	$ 178,000
	b. Advanced Development		$ -0-		
	c. Full-scale Development		$ -0-		
	d. Testing		$ -0-		

TOTAL: INCAPACITATING CHEMICAL PROGRAM	CFY	$ 2,086,000			
	PY	-0-			
			In-House	$	1,908,000
		$ 2,086,000	Contract	$	178,000
4. CHEMICAL DEFENSIVE EQUIPMENT PROGRAM					
a. Exploratory Development					
(1) Physical Protection Investigations	CFY	$ 20,207,000			
	PY	387,000			
			In-House	$	8,838,000
		$ 20,594,000	Contract	$	11,756,000
(2) Warning and Detection Investigations	CFY	$ 5,224,000			
	PY	3,781,000			
			In-House	$	4,291,000
		$ 9,005,000	Contract	$	4,714,000
(3) Medical Defense Against Chemical Agents	CFY	$ 19,124,000			
	PY	(270,000)			
			In-House	$	11,776,000
		$ 18,854,000	Contract	$	7,078,000
TOTAL: Exploratory Development	CFY	$ 44,555,000			
	PY	3,898,000			
			In-House	$	24,905,000
		$ 48,453,000	Contract	$	23,548,000
b. Advanced Development					
(1) Chemical Decontaminating Materiel	CFY	$ 6,122,000			
	PY	-0-	In-House	$	2,304,000
		$ 6,122,000	Contract	$	3,818,000

(2)	Collective Protection Equipment	CFY	$ 1,962,000		
		PY	-0-		
				In-House	$ 555,000
			$ 1,962,000	Contract	$ 1,407,000
(3)	Individual Protection Equipment	CFY	$ 1,280,000		
		PY	-0-		
				In-House	$ 1,280,000
			$ 1,280,000	Contract	$ -0-
(4)	Chemical Detection and Warning Materiel	CFY	$ 7,074,000		
		PY	-0-		
				In-House	$ 2,854,000
			$ 7,074,000	Contract	$ 4,220,000
(5)	Medical Chemical Defense Life Support Materiel	CFY	$ 13,989,000		
		PY	(230,000)		
				In-House	$ 2,689,000
			$ 13,759,000	Contract	$ 11,070,000
(6)	Medical Defense Against Chemical Warfare	CFY	$ 5,892,000		
		PY	(275,000)		
				In-House	$ 2,128,000
			$ 5,617,000	Contract	$ 3,489,000
(7)	CB Defense Systems Advanced Technology	CFY	$ 3,820,000		
		PY	24,000		
				In-House	$ 1,061,000
			$ 3,844,000	Contract	$ 2,783,000

TOTAL: Advanced Development	CFY	$ 40,139,000		
	PY	(481,000)		
			In-House	$ 12,871,000
		$ 39,658,000	Contract	$ 26,787,000
c. Full-scale Development				
(1) Decontamination Concepts and Materiel	CFY	$ 1,100,000		
	PY	-0-		
			In-House	$ 739,000
		$ 1,100,000	Contract	361,000
(2) Collective Protective Systems	CFY	$ 2,916,000		
	PY	-0-		
			In-House	$ 700,000
		$ 2,916,000	Contract	$ 2,216,000
(3) Warning and Detection Equipment	CFY	$ 29,817,000		
	PY	10,515,000		
			In-House	$ 4,238,000
		$ 40,332,000	Contract	$ 36,094,000
(4) Individual Protection Equipment	CFY	$ 4,852,000		
	PY	-0-		
			In-House	$ 715,000
		$ 4,852,000	Contract	$ 4,137,000
(5) Medical Chemical Defense Life Support Materiel	CFY	$ 4,690,000		
	PY	(115,000)		
			In-House	$ 459,000
		$ 4,575,000	Contract	$ 4,116,000
d. Testing		$ -0-		
TOTAL: Full-scale Development	CFY	$ 43,375,000		
	PY	10,400,000		
			In-House	$ 6,851,000
		$ 53,775,000	Contract	$ 46,924,000

TOTAL:	CHEMICAL DEFENSIVE EQUIPMENT PROGRAM	CFY PY	$ 128,069,000 13,817,000		
			$ 141,886,000	In-House Contract	$ 44,627,000 $ 97,259,000
5.	TRAINING SUPPORT		$ -0-		
6.	SIMULANT TEST SUPPORT	CFY PY	$ 2,527,000 -0-		
			$ 2,527,000	In-House Contract	$ 1,082,000 $ 1,445,000
7.	MANAGEMENT AND SUPPORT	CFY PY	$ 17,868,000 32,000		
TOTAL:	MANAGEMENT AND SUPPORT		$ 17,900,000	In-House Contract	$ 14,586,000 $ 3,314,000

EXPLANATION OF OBLIGATION

1. CHEMICAL RESEARCH

a. Basic Research in Life Sciences

(1) Chemical Defense and Chemical Retaliatory Research. Program Element (PE) 61102, Project A71A

This program includes new concepts and the elucidation of mechanisms of decontamination and contamination avoidance; individual and collective protection; reconnaissance, identification, and detection; materials research; simulants; training systems; retaliatory chemical munitions; and properties of chemical threat agents.

During FY 90:

Incorporated a mathematical model into a computer program designed to address the fundamental issues of chemical reactor design for the purpose of removing toxic vapors from air and insuring that the product air is respirable.

Developed an electrochemical technique which measures impedance changes between a liquid and a metal plate coated with a polymer as a method for assessing decontamination damage to coated surfaces.

Established a multi-discipline team of medicinal, quantum and synthetic organic chemists, pharmacologists, and biophysicists to study the biomechanisms and chemistry of volatile anesthetics for the development of special purpose compounds with improved potency and safety.

Designed and initiated synthesis on three novel multi-fluoromethyl substituted cyclohexanes for use in testing the mechanisms of action of volatile anesthetics.

Initiated a collaborative multi-institution, multi-discipline study of alpha adrenergic agonists for use in synthesizing potent and safe special purpose compounds.

(2) Clothing, Shelters and Other Material Systems. PE 61102, Project AH52

The goal of this program is to establish potential technologies for the development of clothing and other protective material systems that will minimize the effects of chemical/biological (CB) agents and heat stress associated with wearing the protective ensemble.

During FY 90:

Updated a five year Reactive Polymers Long Range Plan for the development and utilization of polymers for reactive multi-agent protection. Investigated preliminary approaches to regenerable mustard agent deactivation capability.

Synthesized potential metal coordination compounds for use against VX agents and screened a family of enzymes for activity against G-agent and its simulants.

Investigated polymer blends as carriers for agent catalysts and evaluated conditions for optimal catalytic activity, such as blend ratio, humidity, and stability during storage.

Analyzed catalysts as films by spectroscopy and related spectra to function, stability, and structure to enhance protection of materials.

Identified requirements for blister-type agent detoxification using a catalytic polymer which could enhance protection of materials and demonstrated that the reaction chemistry is very complex.

Synthesized enzymatically and characterized a series of catalysts with controlled molecular weight and three-dimensional orientations for chemical agent degradation.

(3) Medical Chemical Defense Research Program. PE 61102, Project BS11

This program provides basic research by the United States (U.S.) Army to meet Joint Service and Service unique requirements for maximizing survivability and operational effectiveness of troops on the integrated battlefield. Emphasis is directed toward development of new technologies and unique methodologies required to determine and evaluate

biomedical effects resulting from current and potential chemical warfare agents (CW) and therapies. Accomplishments emerging from this effort will serve as the basis for further development of new protective and therapeutic systems against exposure to current and novel CW agents and provide tools necessary for determining mechanisms of action.

During FY 90:

Identified and measured several reliable biochemical markers of acute pulmonary injury.

Continued to examine ultrastructural changes as markers for acute and chronic exposure to pulmonary and vesicant agents.

Continued proof of concept evaluation of catalytic antibody pretreatment approach to protection from CW nerve agent toxicity.

Demonstrated the direct relationship between dose of nerve agent and the number of scavenger molecules required to detoxify the nerve agent.

Developed antibodies against stereoisomers of the nerve agent soman.

Achieved significant improvement in our understanding of nerve agent-induced brain injury.

b. General Chemical Investigations: Exploratory Development. PE 62622, Project A553

CB Defense Assessment Technology

The objectives of this technical area are to identify and evaluate potential CB threat agents and establish the CB threat agent list and priority assessment for the R&D community; to provide the threat analysis and CB defense assessment models for technical decision-making studies; to serve as the DOD and International Center for information and data on simulants for chemical biological agents; to provide CB survivability technology base data and evaluation methodology for assessment of equipment survivability and effects of agent and decontamination material; to acquire and develop special test technologies, analyze foreign intelligence samples; conduct front end analyses; and to provide experimental data for CB model validation, threat/systems assessment, and for analysis of CB defense functional development areas.

During FY 90:

Analyzed 80 foreign intelligence samples for identification of CB threat agents, potential CB threat agents, precursors, and degradation products.

Conducted toxicity screens on several new and potential threat agents via percutaneous and intravenous routes.

Developed a general purpose model to address the dissemination, transport, and diffusion of liquid chemical agents delivered by both red and blue munition systems.

Completed the Integrated Chemical and Biological Defense Front End Analysis which assessed the payoffs to the Army by the introduction of new chemical defense materiel.

Applied state-of-the-art interactive, three-dimensional computer graphics to chemical cloud modeling and assessment of chemical warfare issues.

Provided estimates of threat agent persistency and chemical munition hazard areas in support of Operation Desert Shield.

Developed a Chemical and Biological Modeling Master Plan to guide computer model development programs for the next decade.

Conducted hazard analysis studies and developed a heat conduction model for demilitarization efforts.

Held the 4th Annual International Simulant Workshop in March 90.

Updated the Chemical Agent Simulant Data Center which now includes more than 750 compounds.

Developed methodology to use theoretical methods in chemical threat agent simulant selection.

Developed a predictive model for the persistence of chemical threat agents.

Completed a study using the Fedele model for predicting aerosol penetration through fabrics.

Synthesized several potential threat agents for application to decontamination and treaty verification research.

2. LETHAL CHEMICAL PROGRAM

a. Exploratory Development. PE 62622, Project A554

The objectives of this program are to develop chemical agent/munition systems to provide a dependable and credible deterrent and a safe and modern retaliatory capability; and to maintain advanced technology in chemical agent weaponry to avoid any technological lag or surprise.

During FY 90:

Identified a new lethal compound with potential for defeating the chemically protected combatant.

b. Advanced Development

Anti-Protective Binary Chemical Warhead: PE 63803, Project DE76

The objective was to develop a chemical agent dispersing system, similar to the XM135 Multiple Launch Rocket System (MLRS) Binary Chemical Warhead (BCW), which would be capable of defeating the chemical protection of enemy combatants.

During FY 90:

Conducted a short-term chemical identification, synthesis, and evaluation program aimed at developing sub-lethal agents capable of defeating enemy chemical protection. Results were unsatisfactory and the effort was terminated.

c. Full-scale Development

Multiple Launch Rocket System (MLRS) Binary Chemical Warhead (BCW): XM135 PE 64803, Project DF95

The objective is to develop a free flight chemical agent dispersing system consisting of an XM450 fuse, a warhead, and an injector assembly which will be employed by the MLRS batteries and battalions in the same manner as the MLRS conventional warhead. The BCW will produce a semi-persistent agent which when dispersed will cause immediate casualties on enemy troops and cause them to mask, don protective gear, or restrict themselves to protective structures. This agent will remain effective in the target area for several hours before decomposing. As a system, the MLRS will require only minor modifications to support the requirements of the BCW.

During FY 90:

Continued process equipment acquisition and installation in the Injector Assembly Fill/Close Pre-production Facility.

Received and installed 90% of the special inspection and special test equipment required for the MLRS BCW metal parts and warhead fill pilot line.

Completed 48 scored performance flight tests and 13 dissemination flight tests.

Completed warhead prototype toxic chemical chamber tests and initiated warhead reactor tests.

Completed and tested Fire Controls Systems software.

Received 80% of the required draft Technical Data Package documentation, including Level III drawings, and initiated Government review.

d. Testing No obligations were incurred.

3. INCAPACITATING CHEMICAL PROGRAM

a. Exploratory Development. PE 62622, Project A554

The objectives of this program are to discover new quick acting physically immobilizing compounds which are effective by inhalation; and to synthesize and evaluate potent analgesics and volatile anesthetics to optimize dissemination techniques/hardware to satisfy program requirements.

During FY 90:

Terminated the Incapacitating Chemical Program and initiated a Riot Control Program.

Initiated inhalation studies for the candidate riot control material.

Initiated experimentation to evaluate dissemination techniques of candidate materiel.

Initiated studies to improve methods of synthesis and produce quantities required for the program.

Initiated compatibility and stability tests for each of the candidate riot control components.

b. Advanced Development No obligations were incurred.

c. Full-scale Development No obligations were incurred.

d. Testing No obligations were incurred.

4. CHEMICAL DEFENSIVE EQUIPMENT PROGRAM

a. Exploratory Development

(1) Physical Protection Investigations

Chemical and Biological Decontamination and Contamination Avoidance. PE 62622, Project A553 and PE 62786, Project AH20

The objectives of this program are to investigate procedures, designs, and materials to enhance survivability of troops in a chemical, biological, and radiological environment; to develop equipment to decontaminate personnel, personal items, and

military equipment; to improve the efficiency of the decontamination process; and to develop methods of avoiding or minimizing contamination.

During FY 90:

Continued development of a new, environmentally safe decontaminant for deliberate decontamination operations. This new decontaminant will partially replace the currently fielded decontaminants and will be compatible with the next generation of decontamination hardware.

Replaced the microemulsion formulation with a new solvent, pyrrolidone, due to technical and environmental problems associated with the previous microemulsion formula. Initiated an evaluation of the new formulation to determine decontamination efficacy.

Coordinated with the user community to establish final requirements for the new deliberate decontaminant in preparation for a transition into advanced development next year.

Continued to develop catalytic oxidants suitable for incorporation into the new deliberate decontaminant as part of a pre-planned product improvement effort to improve the new material as new technologies evolve.

Continued efforts in the development of a self-stripping coating for hasty decontamination operations by conducting investigations to improve the auto-release properties of the coating. Initiated preparations for an Advanced Technology Transition Demonstration (ATTD) which is scheduled for a 1992 completion.

Continued studies to develop a non-isocyanate Chemical Agent Resistant Coating (CARC) and continued testing CARC to ensure compliance with all Environmental Protection Agency requirements.

Individual Protection. PE 62622, Project A553 and PE 62786, Project AH98

The objectives are to evolve concepts for individual protection against potential threat agents for Joint Service application; to develop a technical base to study the mechanism of chemical biological protective materials; and to maintain a center of excellence in respiratory protection.

During FY 90:

Designed a thermal protective outsert and initiated development of hand-tooled prototypes for the Aircrew Protective Mask.

Finalized the design of three additional facepiece sizes for the Aircrew Protective Mask.

Designed a new low-profile lens attachment using a Computer Aided Design (CAD) system for the Aircrew Protective Mask. This new lens attachment should allow for superior optical coupling.

Initiated development of a lightweight protective mask. Two concepts, a hood-type and a facepiece-type, have been developed to date.

Held a three-day workshop to design initial concepts for the RESPO 21. Fabricated prototype versions of the soft shell and multi-layer RESPO 21 concepts.

Completed exploratory development of the Mask Fit Validation System and prepared for transition to advanced development.

Upgraded computer and mechanical automation of the protection factor test chambers of the Protection Factor Test Laboratory. Initiated an aerosol characterization study of the protection factor test chambers.

Awarded a contract for test subject support for all physiological testing regarding mask development and evaluation.

Developed a three-dimensional statistical approach for reporting anthropometric data of the human head. Coordinated and standardized this data with other Services.

Coordinated and standardized mask functionality and test methodology with North Atlantic Treaty Organization (NATO) member countries.

Automated data collection of respirator speech testing to reduce test time from twelve weeks to overnight.

Initiated testing of non-traditional methods of respirator speech capability using bone conduction or ear tympanic membranes to both send and receive messages.

Completed visual and speech testing of a number of foreign respirators for establishing a physiological capabilities data base for use in designing future respirators.

Analyzed simulation test data of packaging material and determined that holes in the packaging led to the degradation of physical properties of chemical protective equipment.

Designed a test cell to evaluate reactive/sorptive materials. Automated a microplate reader for use in determining metal content of coordinated reactive polymers, and adapted agent simulant kinetics of reaction to robotic control.

Successfully laminated nylon/reactive polymer blends to the Battle Dress Overgarment.

Evaluated swatches of chemical protective material against aerosol, added this information to a data base, and scaled up the technique for larger samples of material.

Conducted heat stress assessments and completed studies of impact on performance, particularly manual dexterity, in various versions of protective gear.

Selected the best 7 of 70 original materials for the multipurpose overboot and arranged for fabrication of prototype boots.

Evaluated various thermoplastic resins and thermoplastic elastomers and selected those which have outstanding cold flexibility properties, high strength, and barrier properties for multilayer, coextrudable film barrier materials.

Developed a new prototype two-layer, flame retardant chemical protective glove.

Collective Protection. PE 62622, Project A553 and PE 62786, Project AH98

The objectives of this program are to evolve concepts for collective protection against present and future threat agents for Joint Service application; and to develop

and maintain a technical base on the mechanisms of protection against chemical and biological agents.

During FY 90:

Completed development of a pressure swing adsorption prototype for a filtration test bed.

Continued a development program to eliminate the use of chromium, a hazardous material, from the current military adsorbent, ASC carbon, used in chemical and biological filters. Formulated a new chromium-free material since environmental exposure testing of the initial formula's agent filtration performance was determined to degrade to unacceptable levels.

Continued development of the Reactive Bed Plasma technology for destruction of chemical and biological agents. Initiated design of a 100 cubic feet per minute prototype reactor in support of an independent panel's recommendation to continue investigating reaction mechanisms of electric discharge plasma technology.

Continued an accelerated development program of a new reactive sorbent for NBC filter systems to provide broader protection capability than that provided by the current military adsorbent, ASC carbon. Completed preliminary optimization and a report of an additional impregnant formulation and initiated laboratory studies of the impregnation process to identify the best methods of manufacturing the new sorbent.

Continued investigations to identify the sorption mechanisms of nonstandard agents and prepared a technical report on the results to date.

Collected data on contaminant infiltration rates of tentage materials and adapted a computer code utilizing computational fluid dynamics to model infiltration of contaminants into fabric structures.

Initiated collective protection investigations such as pressure swing adsorption and catalytic oxidation technologies (including laboratory and field experiments), prototype hardware fabrication, and evaluation and performance prediction by mathematical modeling to support the Armored Systems Modernization Program.

Initiated investigations into chemical detection sample transfer system and auxiliary powered/environmental control system technologies to support the Armored Systems Modernization Program. Provided prototype Automatic Chemical Agent Alarm (ACADA) systems for the Tank Automotive Command's Component Advanced Technology Test Bed (CATTB) Phase I demonstration. Initiated efforts to provide support and prototype hardware for Phase II demonstration.

Initiated contract and in-house efforts to develop a generic performance specification for incorporation of NBC subsystems into the Tank Automotive Command's Block III tank full-scale development contract. Initiated mathematical modeling to support the integration of NBC subsystems.

(2) Warning and Detection Investigations, PE 62622, Project A553

Reconnaissance, Detection, and Identification

The objectives of this program are to evolve new and improved concepts, methods, and materials for point detection, identification, and warning for all chemical and biological agents for Joint Service applications; to develop concepts for product improvement programs to upgrade standard chemical and biological agent point detectors; and to update and maintain a Reconnaissance, Detection, and Identification (RDI) Master Plan.

During FY 90:

CB Mass Spectrometer (CBMS) Technology:

Fabricated a breadboard unit under the CBMS exploratory development contract.

Initiated chemical testing of the breadboard unit.

Explored and evaluated parallel approaches to produce expert systems (complex interpretation algorithms) using daughter ion analysis and principle component analysis.

Explored and evaluated artificial intelligence approaches to data interpretation including neural networks computing for identification of chemical warfare agents.

Stand-off Detection Technology:

Awarded a contract for a lightweight frequency agile laser that will provide rapid area detection for the Nuclear, Biological and Chemical (NBC) Reconnaissance Vehicle program.

Conducted a laser stand-off detection field test with French joint participation.

Developed an integrated algorithm for the laser chemical stand-off detector.

Built and tested a digital signal processor for real time stand-off detection pattern recognition.

Built and tested a lightweight (16 pound) interferometer for the Unmanned Aerial Vehicle and the Helicopter Vapor Stand-off Detector.

Improved unique spatial frequency detection techniques for forward looking infrared imagery.

Bio-Chemical (BC) Detector Technology:

Continued the collaborative development program for the BC Detector with the United Kingdom and Canada.

Conducted breadboard development, fabrication and testing. Continued assay development and optimization of assays to be used in the BC Detector.

(3) Medical Defense Against Chemical Agents. PE 62787, Project A875

This program supports the Joint Service and Service unique exploratory development for medical chemical defense. It emphasizes the prevention of casualties through application of drugs or chemical compounds for prevention or treatment of the toxic processes of conventional and novel CW agents. A majority of the resources supports development of prophylactic/pretreatment compounds, antidotes, skin decontaminants, and therapeutic agents that will counteract the lethal, physical, and behavioral decrements

of CW agents. The remainder of the resources supports development of medical materiel that insures adequate patient care, field resuscitation, and patient management procedures.

During FY 90:

Continued to employ a computer-assisted drug modeling capability for conducting directed synthesis of drugs to potentially improve medical countermeasures to chemical warfare agents.

Implemented the use of decision tree networks for the rapid selection of candidate antidotes, pretreatments, and topical protectants against CW threat agents.

Continued the active screening of compounds for efficacy against CW threat agents.

Continued to monitor chemical agent presence in biological fluids, air samples and environmental liquid samples.

Tested ten topical protectant candidates for efficacy against nerve and blister CW agents and selected two for transition to advanced development.

Identified a commercially available nondevelopment item (NDI) skin protectant which is an effective barrier to sulfur mustard.

b. Advanced Development

(1) Chemical Decontaminating Materiel

Non-aqueous Equipment Decontamination System (NAEDS): PE 63806, Project DE81

This system is being developed to provide a capability to the soldier and/or airman to decontaminate equipment such as avionics devices, communication and electronics equipment, optical sights, and medical equipment. The system will consist of three main assemblies: a glove box cabinet with hand-held pressure spray devices and a solvent distillation and purification system; a self diagnostic electronic control console; and a world-wide electrical power adapter for conversion to U.S. from European power sources.

During FY 90:

Fabricated two prototypes and initiated chemical surety materials testing and reliability testing.

Obtained approval of the Joint Service Requirements Document.

Continued work on the development of the Technical Data Package.

Initiated investigations into the replacement of the current system solvents with environmentally acceptable solvents.

Modular Decontamination System (MDS): PE 63806, Project DE81

The MDS will provide greater reliability, mobility, and operational flexibility than existing assets for deliberate decontamination and will be less labor intensive. Development items include the XM21 Decontaminant Applicator module and the XM22 High Pressure Washer module. The XM21 is capable of applying standard and field expedient decontaminants during the decontaminant application step of the deliberate vehicle decontamination process. The XM22 will be used during the pre-wash step of the deliberate vehicle decontamination process and is capable of drawing water from natural water sources and delivering it at variable, adjustable pressures from 100 to 1500 pounds per square inch. The development items will be augmented with existing, standard water pumping, heating, and storage equipment needed to support decontamination operations.

During FY 90:

Prepared and updated engineering drawings detailing system design.

Fabricated prototype systems for use in engineering and early User Tests.

Conducted engineering tests of the XM21 and XM22 modules.

Completed an early User Test in June 90.

Designed a powered scrub brush for the XM21 to improve human factors, reduce weight, and improve effectiveness.

Completed an evaluation of contractor proposals for development support and initial production.

Laundry and Dry Cleaning Decontamination System (LADDS): PE 63747, Project DC09

This system is being developed to perform non-aqueous dry cleaning and decontamination of clothing and individual equipment items exposed to vegetable stains, dirt, sweat, petroleum products and to NBC contamination. The proposed system will eliminate the present dependency for water, reduce the resource requirements of current systems, and increase the rate at which chemical agents are decontaminated.

During FY 90:

Retrofitted and prepared two prototypes for testing.

Initiated Technical Testing.

(2) Collective Protection Concepts

Standard Integrated Command Post System (SICPS): PE 63804, Project D428

The SICPS will integrate chemical and electromagnetic protection into a shelter system to fit on the High Mobility Multipurpose Wheeled Vehicle and the Commercial Utility Cargo Vehicle. The shelter will be integrated with power, air conditioning, ventilation, lights, and racks to support the communications and electronics equipment utilized for command, control, and communications and intelligence (C3I) missions.

During FY 90:

Transitioned program to full-scale development phase in May 90 and initiated Technical Testing.

Chemical and Biological Protected Shelter (CBPS): PE 63804, Project D428

The CBPS will be a highly mobile system providing a contamination-free environmentally-controlled working area for a Battalion Aid Station, moving up to three

times a day, or a Division Clearing Station (two systems joined together) moving once every three days. The system will be easy to erect, have increased floor space, improved air lock operation, natural ventilation capability, and be issued with a prime mover. This unit will be a direct replacement for the M51 shelter system.

During FY 90:

Completed construction of two redesigned prototype shelters and initiated construction of a third one.

Conducted Milestone I/II In-Process Review.

NBC Contamination Survivability: PE 63806, Project DJ30

The objectives are to develop, manage, apply, and execute programs in Nuclear, Biological, and Chemical Contamination Survivability (NBCCS) for implementation of both DOD Instruction 4245.13, Design and Acquisition of Nuclear, Biological, and Chemical (NBC Contamination-Survivability Systems and Army Regulation 70-71, NBC Contamination Survivability of Army Materiel; to develop, manage, apply and execute programs for integration of NBC defense and smoke/obscuration items into Army and other Service systems; and to apply and assist-in-application of the concepts and technologies to Army and other Service systems.

During FY 90:

Initiated an NBCCS testing program to evaluate/assess current hardware/equipment against the NBCCS criteria.

Assisted in coordination and review of testing for the evaluation of the NBCCS of wooden pallets in support of the Program Manager for Ammunition Logistics.

Briefed all Training and Doctrine Command (TRADOC) schools on NBC survivability. Discussed vulnerability and how to mitigate the effects of NBC contaminants/ decontaminants, emphasizing that the development process must start with a well-defined requirements document.

Provided assistance/technical support to TRADOC in the revision of AR 71-14, Procedures for Incorporating Nuclear Survivability and NBC Contamination Survivability for Army Materiel in the Development and Acquisition Process.

Provided instructions for combat developers on how to integrate NBC issues into requirements documents.

Storage Devices: PE 63804, Project DK39

The objective is to evaluate coated fabric materials currently used in Army collapsible water storage tanks and new innovative coated fabrics for future use.

During FY 90:

Tested the coated fabrics to determine resistance to chemical agent contamination and capability to withstand decontamination.

Microclimate Cooling for the All Terrain Lifter Articulated System (ATLAS) Forklift: PE 63804, Project DG14

The objective is to develop a thermoelectric microclimate cooler for the ATLAS forklift vehicle to increase the capability of the system to function in an NBC environment.

During FY90:

Fabricated a prototype system and installed it on the vehicle. Initiated an evaluation of the system with emphasis on vehicle/operator interface.

(3) **Individual Protection Concepts**

Individual Microclimate Cooling System: PE 63747, Project D669

This program will provide auxiliary cooling equipment for dissipating metabolic heat while performing operational tasks on and off vehicles/aircraft in hot dry/wet environments. Cooling will be accomplished by circulating chilled liquid or

chemical/biologically filtered conditioned air (supplied by the vehicle cooling unit or individually worn backpack) through a garment.

During FY 90:

Received an improved hermetic compressor, containing an alternator and water pump, to reduce the number of components in the microclimate cooling backpack.

Redesigned and received an improved migrating combustion chamber engine as the power source to the microclimate cooling backpack.

Investigated possible designs incorporating the compressor and engine to form an improved microclimate cooling backpack.

Accelerated Self-contained Toxic Environment Protective Outfit - Interim: (STEPO-I) PE 63747, Project D669

The STEPO-I will provide two hours of protection from CW agents for depot workers in immediate danger to life and health situations. The suit will be integrated with a non-filtered four-hour breathing system and a one-hour microclimate cooling system. Current off-the-shelf technologies will be utilized to expedite this effort.

During FY 90:

Completed protection factor testing on the breathing system.

Continued health hazard assessments.

Self-contained Toxic Environment Protective Outfit (STEPO): PE 63747, Project D669

STEPO will provide four hours of protection against chemical/biological agents; industrial chemicals; petroleums, oils, and lubricant products; and radioactive particles for use by explosive ordnance disposal and depot workers. The suit will be integrated with a non-filtered four-hour breathing system and microclimate cooling system.

During FY 90:

Completed physiological studies in a simulated tropical environment.

Established anthropometric dimensions and size scale.

Awarded a design contract for incorporating major design changes.

(4) Chemical Detection and Warning Materiel

Multipurpose Integrated Chemical Agent Alarm (MICAD): PE 63806, Project D601

The MICAD is a multifaceted interface to existing and developmental nuclear, biological and chemical (NBC) agent detectors. It provides data display and operator control, a sample transfer system, and a telemetry link. MICAD will activate automatic collective protection equipment and transmit formatted NBC messages to other battlefield communication nodes, when alarm data is received from either a local detector or via command and control radio from remotely-located detectors.

During FY90:

Approved an Acquisition Plan and a Computer Resource Management Plan.

Updated and approved a System Manprint Management Plan.

Awarded a contract for advanced development of the MICAD.

Chemical Agent Detector Network (CADNET, XM23/XM24): PE 63806, Project D601

The objective of this project is to provide a means for rapidly and automatically or semi-automatically relaying a chemical agent alarm throughout the battlefield. CADNET receives an alarm signal from a chemical agent detector, transmits the alarm via modified Platoon Early Warning System (PEWS) transmitter and receiver radios, then transforms the alarm signal to a format for further retransmission via the platoon and/or company radio network. The M42 Alarm can be inserted at local or remote nodes to provide an audible chemical alarm to personnel.

During FY 90:

Completed testing of the CADNET discrete component brassboard with tactical radios.

Awarded contractual tasks for the completion of the CADNET test article assembly effort.

Conducted a reliability, availability, and maintainability (RAM) joint working group meeting and submitted the RAM rationale report for approval.

Obtained approval of the safety assessment report and system safety hazard analysis.

Updated the material system requirements specification for preparation of the FY 91 Baseline Cost Estimate.

Updated the configuration management plan and technical manuals.

Automatic Chemical Agent Alarm (ACADA, XM22): PE 63806, Project D601

The objective of this task is to develop an advanced point-sampling, chemical agent alarm system for multipurpose use as an automatic alarm to provide area warning, a survey instrument to detect contaminated surfaces, and a monitor inside collective protection shelters. The XM22 ACADA will detect and identify all standard nerve and blister agents and will be reprogrammable to incorporate new threat agents.

During FY 90:

Conducted Milestone II In-Process Review.

Established informal Government configuration control.

Finalized the Technical Data Package during the advanced development phase.

Fabricated collective protection equipment (CPE) adapters and conducted CPE adapter system verification tests.

Fabricated detector units in support of the Armored Systems Modernization (ASM) and MICAD programs.

(5) Medical Chemical Defense Life Support Materiel, PE 63002, Project D995

Nonsystem:

The purpose of this program is to support the Department of Defense nonsystem advanced development for medical chemical defense. It utilizes state-of-the-art biomedical technology and further screens candidate compounds. Analytical and stability studies are performed on advanced candidate compounds. It also supports development of "breadboard" materiel models.

During FY 90:

Continued the evaluation of cyanide pretreatment compounds.

Continued an improved nerve agent antidote pre-development project.

Determined the effects of nerve agent protective pretreatment on pilot performance, physiology, and vision in a UH60 Flight Simulator.

Established performance assessment database describing the impact of stressors or pharmacological agents on performance of military duties.

(6) Medical Defense Against Chemical Warfare, PE 63807, Project D993

The objective of this program is to achieve a modern and viable capability for fielding medical defense against CW agents to meet the Joint Service Requirements. The advanced development includes specific prophylactic/pretreatment, antidotal and therapeutic drugs as well as skin decontaminants and specialized medical materiel for diagnosis and management of both chemical and chemical/conventional casualties, which will provide the soldier maximum protection and survivability on the integrated battlefield. This project provides for advanced development of medical equipment specifically required to treat chemical casualties. This project also provides for development of assessment methodology for determination of drug-induced soldier performance decrements and limits. It supports advanced drug development efforts on formulation stability, final dosage studies, and preclinical toxicity studies.

During FY 90:

Completed clinical evaluation of a sustained release pyridostigmine to be used as a pretreatment for nerve agent poisoning.

Filed a new drug application with the Food and Drug Administration for an anticonvulsant therapy for nerve agent poisoning.

Filed a new drug application with the Food and Drug Administration for an aerosolized antidote for nerve agent poisoning.

Completed technical tests of two Life Detector prototypes.

Conducted Milestone II In-Process Review of commercial and developmental prototypes of Vital Signs Monitors for assessing vital signs of personnel while in protective clothing and recommended a modified nondevelopmental item.

Successfully conducted operational tests of modified prototypes of powered ventilatory assistance devices.

Successfully conducted operational tests of prototype mounting systems for the Ballistic-Laser Protective Spectacles prescription lens carrier in the M-40 CB Protective Mask.

Conducted Milestone II/III In-Process Review of commercial and developmental prototypes of the Respirator Device, Individual Chemical and recommended a modified nondevelopmental item.

(7) <u>CB Defense Systems Advanced Technology</u>

The objective is to conduct Advanced Technology Transition Demonstrations (ATTDs) of technologies and materiel in support of deterrence and defense against chemical and biological warfare as well as ATTDs for equipment defeating munitions. The Army is the DOD Executive Agent for Chemical Warfare (CW) and Chemical and Biological Defense (CBD) Research. ATTDs are conducted in an operational environment with active user and developer participation and demonstrate capabilities to integrate diverse technologies to improve DOD CW deterrence and CB Defense. ATTDs will speed maturing of advanced technologies and reduce risk in the development programs of next generation and future systems.

BC Detector: PE 63759, Project DE83

The objective is to demonstrate a full-up working prototype of the BC Detector, the first unit issue biodetection capability within NATO. Since the BC Detector is based on high risk, state-of-the-art technology, this demonstration will significantly reduce the risk associated with development of the concept model required in the Proof of Principle phase. The BC Detector is a hand-carried, automatic, point sampling alarm for detecting chemical and biological warfare agents. The alarm will have the capability to classify and to semi-quantitate nerve, blister, blood toxin, and pathogen agents. The system will be modular in nature to allow for upgrade in anticipation of advances in technology or changes in the CB threat. The Pre-planned Product Improvement program will add a capability for generic detection of all agents. Key technologies include Ion Mobility Spectrometry; biotechnology (monoclonal antibodies, receptor sites, and automated antibody immunoassay); miniaturized aerosol sampling (virtual impaction); biosensors (Light Addressable Potentiometric System) and transputers. The BC Detector will ultimately replace all field detectors in the Unit Detection and Warning System. It will also provide future generic detection of all CB agents and possible replacement of the ACADA on the NBC Reconnaissance System and Heavy Force Modernization.

During FY 90:

Fabricated, via contract, breadboard models of the BC Detector in a configuration that could be easily tested outside of a laboratory.

Planned for and initiated in-house testing of the aerosol collector.

CB Mass Spectrometer: PE 63759, Project DE83

The objective is to demonstrate the ability of a prototype mass spectrometer to detect, identify and determine semi-quantitative concentrations of chemical and biological agents present in ambient air as vapor, aerosol, or liquid droplets. This ATTD involves the design, development and demonstration of a sampling front end, a pyrolysis subsystem for biological particle sample dissociation and introduction, a small mass analyzer, and algorithms for rapid analysis of mass spectra. The CB Mass Spectrometer (CBMS) will be a fully automatic, multipurpose point detection and identification system capable of detecting known and unknown CB agents. The CBMS will

be a component of the NBC Reconnaissance System and a component of the Fixed Site Detection and Warning System. It will be modular to accommodate future advances in hardware technology and changes in the CB threat. Key technologies include quadropole ion storage, multistage impaction, infrared pyrolysis, and artificial intelligence.

During FY 90:

Fabricated an additional breadboard unit under the CBMS exploratory development contract for use in the ATTD.

Developed and coordinated an ATTD test plan with the combat developer.

Conducted chemical agent testing of the breadboard model.

Penetrant Assessment: PE 63759, Project DE83

The objective is to evaluate the protective capabilities of the current stock of collective protection filters (M48 gas filter, M56 gas filter, and C2 filter canister) against nonstandard chemical agents at various operational and environmental conditions. The existing filters will then be challenged using new impregnants for comparison. An assessment will be conducted of the efficiency of application of recent advances in protective technologies (Reactive Bed Plasma and Pressure Swing Adsorption) and materials in providing effective individual and collective protection against an emerging class of CB threat agents intended to penetrate classical filters.

During FY 90:

Established a test capability and tested ASC carbon and candidate new filtration media against the four highest priority potential penetrants. Produced numerous technical reports documenting performance of filters against penetrants.

Initiated a testing and evaluating C2 canisters, a component of the M40 series respirators.

Established a large filter test facility for evaluation of the M48 and Modular Collective Protection Equipment filters against potential penetrant compounds.

Awarded a contract for testing advanced air purification prototypes, using Pressure

Swing Adsorption and Catalytic-Oxidation technologies, against selected penetrants.

c. Full-scale Development

(1) Decontamination Concepts and Materiel

Individual Equipment Decontamination: XM295 PE 64806, Project DP97

The XM295 kit will be used to decontaminate a soldier's individual equipment, which includes the chemical/biological protective mask/hood, gloves, footwear, weapon, helmet, and load bearing equipment. The XM295 kit will reduce soldier agent exposure, will minimize the agent penetration into surfaces of individual equipment, and will minimize agent transfer during battle dress/overgarment exchange, and entry/exit procedures. The XM295 will consist of a mitt device which will be used to disperse a sorbent resin and physically remove agent contamination.

During FY 90:

Completed a three-part comparative test and chose the sorbent resin technology for the XM295 development program.

Completed a Trade-Off Determination which demonstrated the logistic benefits of the XM295 system.

Awarded and completed a contractual task to develop three experimental XM295 prototypes which were used in a Human Factors Evaluation.

Initiated testing to determine the number of mitts required in the XM295 kit to perform one full decontamination operation.

(2) Collective Protection Systems

Simplified Collective Protection Equipment (SCPE) M20E1/XM28: Pre-planned Product Improvement (P3I) PE 64806, Project DO17

The objective of the SCPE-P3I program is to expand the capability of the current system, M20 SCPE by incorporating improvements specified in the requirement document. The requirements to be satisfied are: a liquid resistant liner material; an increased

entry/exit rate; interface with existing environmental control units; interface with Tent, Extendable, Modular, Personnel (TEMPER); a medical airlock for litter patients, an expansion of the protected area, and reduced electromagnetic interference. The SCPE-P3I program will generate five end items. The first, the M20E1, will have the M20 mission profile and will replace it by attrition. The other four end items will consist of four configurations of the XM28 which will provide collective protection for tentage and will address Corps Hospital and Air Force Bare Base needs. Both the M20E1 and the XM28 are lightweight modular systems.

During FY 90:

Implemented government configuration control of the design.

Fabricated prototype systems for Technical Testing/User Testing at the various Government test sites.

Delivered test prototypes to the test sites and initiated Technical Testing/User Testing at appropriate test sites.

Successfully conducted Cold Region Technical Test series for both the M20E1 and XM28.

Successfully completed User Testing of the XM28 SCPE.

Accelerated the test program for the XM28 SCPE to support Operation Desert Shield.

Chemical/Biological Hardened Rigid Wall Shelter (Nonexpandable): PE 64804, Project D429

The objective is to develop a Non-expandable Rigid Wall Shelter using Army standard Modular Collective Protection Equipment, to provide a shirt-sleeve environment for equipment operators during chemical/biological warfare.

During FY 90:

Completed the Technical Data Package, excluding the electromagnetic interference protection capability.

Concluded Milestone III and transitioned the program to production.

Chemical/Biological Hardened Expandable Rigid Wall Shelter: PE 64804, Project D429

The objective to develop a Chemical/Biological Hardened Rigid Wall Shelter, using Army standard Modular Collective Protection Equipment, to provide chemical and biological protection for the Army-standard one-side and two-side expandable tactical shelters and the personnel and equipment operating inside the shelter.

During FY 90:

Completed coordinated corrective actions on the environmental control units.

Initiated the Technical Test on the one-side prototype shelter.

Completed the Technical Test on the two-side prototype shelter.

Nuclear, Biological, and Chemical-Protective Covers (NBC-PC): PE 63713, Project DC40

The objective is to develop a lightweight, disposable cover for supplies and equipment that has camouflage patterning, will survive 45 days of environmental exposure, and provide a minimum of 72 hours of protection against liquid chemical/biological agents and ambient temperature nuclear dust.

During FY 90:

Redesigned the NBC-Protective Covers to incorporate camouflage patterning and environmental exposure requirements.

Awarded contract for and received camouflage patterned NBC-Protective Covers.

Conducted live agent testing of NBC-Protective Covers and environmental challenge testing of the NBC-Protective Cover fabric.

(3) Warning and Detection Equipment

Reconnaissance System, Nuclear, Biological, Chemical (NBCRS): XM93E1 PE 64806, Project D020

The objective is to develop a system to fill an urgent operational need which integrates a variety of sensors/detectors and auxiliary subsystems into a host vehicle dedicated to conducting nuclear, biological, and chemical (NBC) reconnaissance. This system will collect and report NBC contamination faster and more accurately than is currently possible. The NBCRS will be composed of chemical and nuclear detectors, a navigation system, a central data processor, a digital jam-resistant communication systems, a life support system which provides vehicle overpressure with NBC filtration and heating and cooling for the crew members, a mechanized sampling and collection system, a marking system, and a meteorological system. The program is being conducted as a Nondevelopment Item (NDI) under the Department of Defense Directorate of Operational Test & Evaluation oversight. The NBCRS development is receiving special Army emphasis through the application of intensive project management by the Project Manager NBC

During FY 90:

Completed a competitive test of candidate systems in accordance with Congressional direction and completed source selection.

Awarded a production contract to produce 48 interim NBCRS to fulfill an urgent Army requirement.

Awarded a contract to develop an Improved NBCRS which meets all Required Operational Capabilities.

Conducted the first quarterly review to establish the program, set schedules, review data item deliverables, and review design plans.

Remote Sensing Chemical Agent Alarm, (RSCAAL): XM21 PE 64806, Project D020

The Remote Sensing Chemical Agent Alarm, XM21, is an automatic scanning, passive, infrared sensor which detects both nerve and blister agent vapor clouds based on changes in the infrared signature of the background viewed (remote objects/terrain/sky) caused by the agent cloud(s). The XM21 will scan a 60-degree arc and is effective at line-of-sight distances of 2-3 miles. The XM21 system consists of a detector unit, tripod, and a transit case. The XM21 can be powered by standard military power sources. The Marine Corps and the Air Force plan to use the XM21 on its tripod for point or area

surveillance missions. The Army plans to issue an XM21 to each NBC Reconnaissance Team for use on its tripod or mounted to the NBC Reconnaissance System (NBCRS) for surveillance and reconnaissance missions. All integration with the NBCRS will be accomplished under the NBCRS System Improvement Program. The XM21 development is receiving special Army emphasis through the application of intensive project management by the Project Manager NBC Defense Systems due to its use with the NBC Reconnaissance System and fielding requirements from the other services.

During FY 90:

Completed all Technical Testing of prototype systems.

Completed initial operational test and evaluation.

Completed initial and final production readiness reviews.

Automatic Chemical Agent Alarm (ACADA): XM22 PE 64806, Project D020

The objective of this task is to develop an advanced point-sampling, chemical agent alarm system for multi-purpose use as an automatic alarm to provide area warning, a survey instrument to detect contaminated surfaces, and a monitor inside collective protection shelters. The XM22 ACADA will detect and identify all standard nerve and blister agents and will be reprogrammable to incorporate new threat agents.

During FY 90:

Awarded a contract for full-scale development of the ACADA.

(4) **Individual Protection Equipment**

Mask, Chemical/Biological, M40 Pre-planned Product Improvement (P3I): PE 64806, Project D019

The objective of the M40 P3I program is to fabricate improved vision correction prototypes, develop laser/ballistic outserts, refine canister interoperability, improve communications, and develop a quick-doff hood.

During FY 90:

Completed design of the canister interoperability and quick-doff hood components for the M40 P3I mask program.

Aircrew Chemical/Biological (CB) Protective Mask, M43: Pre-planned Product Improvement (P3I) PE 64801, Project DC45

The M43 CB Protective Mask was developed on a greatly accelerated schedule in order to meet the fielding dates of the AH-64 aircraft. Program management recognized that certain technical requirements could not be met within the compressed time period dictated by the fielding schedule. An Acquisition Strategy was selected which included a Pre-planned Product Improvement Program to address improved capabilities in nuclear survivability, chemical decontamination, corrective optics, and equipment integration. The Pre-planned Product Improvement Program is scheduled for completion in FY 91.

During FY 90:

Completed fabrication of M43E1 systems for Technical/User Test programs.

Completed Technical/User Test Programs.

Accelerated program documentation in support of Milestone III In-Process Review for type classification to support Operation Desert Shield.

Mask Drinking System (MDS): PE 64713, Project DL40

This program will develop a lightweight, expendable, pressurized hydration system to deliver liquids from the canteen to the soldier while wearing a protective mask with a drinking capability. The MDS will be compatible with existing standard issue items.

During FY 90:

Determined that the nondevelopmental item approach was unacceptable for meeting the user requirements and recommended initiation of a full-scale developmental program.

Aircrew Microclimate Conditioning System: PE 64801, Project DB45

The objective is to develop an Aircrew Microclimate Conditioning System using new

solid state cooling technology (thermoelectric) which is more reliable and requires no moving parts or gaseous or liquid compressors. The lightweight cooling package will be designed for 2-man and up to 6-man crew applications. It is readily attached (similar to cargo items) in the OH-58, UH1, UH60, and CH47 Army helicopters. Quick disconnect air hoses transport the NBC filtered, conditioned air from the cooler to the air vent worn under the chemical protective ensemble. The system has been sized to maintain a normal body temperature during the metabolic work rates peculiar to aircraft operations making this approach the smallest and lightest possible flight worthy aircrew microclimate conditioning system.

During FY 90:

Designed and fabricated improved components (solid state controls and stackable cooling rings).

Readied a 4-man system for fabrication incorporating improved components into a total system for NBC protective factor evaluations using simulants for the NBC threat.

Initiated preparations to support an early FY 91 Milestone I/II In-Process Review.

(5) Medical Chemical Defense Life Support Materiel: PE 64807, Project 848

The purpose of this program is to complete the technical data packages necessary for the fielding and logistical support requirements for medical equipment, supplies and drugs essential to counteracting the chemical threat on the integrated battlefield. This effort will fund full-scale development of drugs and medical materiel through low-rate initial production. Additionally, foreign medical materiel may be acquired for explcitation of advanced technology and development to meet medical chemical defense goals.

During FY 90:

Initiated delivery of vision correction inserts for the M-40 CB Protective Mask.

Initiated production acceptance testing of a decontaminable folding litter.

Transitioned the XM291 Skin Decontaminating Kit which will replace the M258A1 Personal Decontamination Kit and the M58A1 Training Aid to full production.

Initiated field testing of a field medical oxygen generator.

d. Testing

(1) Materiel Test in Support of Joint Operational Plans and/or Service Requirements:

No obligations were incurred.

(2) Army Materiel Suitability Tests

No obligations were incurred.

5. TRAINING SUPPORT

No obligations were incurred.

6. SIMULANT TEST SUPPORT, PE 65710, Project D049

The objective of this program is to plan, conduct, evaluate, and report on joint tests (for other than developmental hardware) and accomplish operational research assessments in response to requirements received from the Commanders-In-Chief and Services; to serve as the DOD joint point of contact for chemical and biological defense tests and technical data; and to publish and maintain the CB Technical Data Source Book.

During FY 90:

Decontamination Effectiveness of Dirt and Dust: Completed a study evaluating the effectiveness of various types of dirt and dust in absorbing liquid agent contamination on vehicle surfaces, weapons, Alice packs, and web gear.

Quick Response and Planning Digest: Continued to provide quick response in the form of literature searches and technical evaluations to inquiries from Department of Defense elements.

Joint Chemical/Biological (CB) Technical Data Source Book: Continued the preparation of a series of volumes addressing the analysis of CB weapons and defense systems. Published Volume XVIII Chemical/Biological Protective Equipment, Part I, Collective Protection.

Chemical Protection Afforded by Standard Uniforms: Completed four of ten laboratory tests concerning protection levels against threat agents provided by standard clothing items and protective ensembles.

Mission Oriented Protective Posture (MOPP) Effects on the Civilian Work Force: Completed a study using a cross-section of the civilian work force and available heat-stress data to make estimates of the effects of MOPP on older workers.

Chemical Warfare Defensive Equipment Transport Requirements: Completed a study to investigate the capabilities of units and individuals to transport Nuclear, Biological, Chemical (NBC) defense equipment.

Effects of Fog Oil on the Chemical Protective Overgarment: Completed a study determining the extent that the Chemical Protective Overgarment is degraded by fog oil.

Effect of Chin Strap on Protective Mask Seal: Completed a study to determine if an effective protective mask seal can be maintained while the helmet chin strap is being worn.

MOPP Exchange Procedures: Completed a study quantifying the benefits derived from hasty and deliberate decontamination and investigating the effectiveness of decontamination operations during nighttime.

Submicron Particle Concepts: Completed a study evaluating the respiratory and percutaneous hazard posed by submicron biological and chemical weapons.

Grave Registration Unit Operations in a Toxic Environment: Completed a test determining the procedures required to ensure that personal belongings and human remains may be safely returned to the continental United States after exposures to CW/BW agents.

Field Laundering of Protective Equipment: Completed a study determining if

chemical protective overgarments can be laundered and re-used.

Vulnerability of Mobilization Assembly Areas: Completed a study assessing the vulnerability to CB attack of assembly areas likely to be created during mobilization activities.

7. MANAGEMENT AND SUPPORT PE 65801, Project MM55; PE 65896, Project M1ZZ; PE 65872, Project DE98; PE 65709, Project D650; PE 65872, Project DE89; and PE 65502, Project MM40

The objectives of this program are to provide maintenance support of laboratories; to conduct studies and analyses in support of research and development programs; and to support military construction of RDTE facilities.

During FY 90:

Purchased several pieces of state-of-the-art laboratory equipment.

Awarded 16 new Small Business Innovative Research type contracts.

Continued to purchase various computer network system upgrades.

Held the 9th annual Scientific Conference on Chemical Defense Research. As many as 400 scientists and engineers attended this conference.

SECTION II

OBLIGATION REPORT ON BIOLOGICAL DEFENSE RESEARCH PROGRAM

FOR THE PERIOD 1 OCTOBER 1989 THROUGH 30 SEPTEMBER 1990

DEPARTMENT OF THE ARMY

RCS: DD-USDRE (A) 1065

DESCRIPTION OF RDTE EFFORT FOR THE BIOLOGICAL DEFENSE RESEARCH PROGRAM

During FY 90, the Department of the Army obligated $75,272,000 for biological research investigations and the development and test of physical and medical defense systems.

FUNDS OBLIGATED

Current Fiscal Year	(CFY)	$ 75,377,000	
Prior Year	(PY)	105,000)	
			In-House $ 35,531,000
TOTAL		$ 75,272,000	Contract $ 39,741,000

Breakdown of Program Areas

1. BIOLOGICAL DEFENSE RESEARCH

a. Basic Research in Life Sciences	CFY	$ 507,000	
	PY	-0-	
			In-House $ 486,000
	$	507,000	Contract $ 21,000
b. Medical Biological Defense	CFY	$ 17,462,000	
	PY	(9,000)	
			In-House $ 11,247,000
	$	17,453,000	Contract $ 6,206,000
c. Exploratory Development	CFY	$ 10,837,000	
	PY	-0-	
			In-House $ 3,157,000
	$	10,837,000	Contract $ 7,680,000
TOTAL: BIOLOGICAL DEFENSE RESEARCH	CFY	$ 28,806,000	
	PY	(9,000)	
			In-House $ 14,890,000
	$	28,797,000	Contract $ 13,907,000

2.	**DEFENSE SYSTEMS**				
	a. Exploratory Development	CFY	$ 19,069,000		
		PY	(117,000)		
				In-house $	12,756,000
			$ 18,952,000	Contract $	6,196,000
	b. Advanced Development	CFY	$ 20,186,000		
		PY	20,000		
				In-House $	7,052,000
			$ 20,206,000	Contract $	13,154,000
	c. Full-Scale Development	CFY	$ 7,316,000		
		PY	1,000		
				In-House $	833,000
			$ 7,317,000	Contract $	6,484,000
	d. Testing		-0-		
TOTAL:	**DEFENSE SYSTEMS**	CFY	$ 46,571,000		
		PY	(96,000)		
				In-House $	20,641,000
			$ 46,475,000	Contract $	25,834,000
3.	**SIMULANT TEST SUPPORT**	CFY	$ -0-		
		PY	-0-		
			$ -0-	In-House $	-0-
				Contract $	-0-
4.	**MANAGEMENT AND SUPPORT**	CFY	$ -0-		
		PY	-0-		
				In-House $	-0-
			$ -0-	Contract $	-0-

1. BIOLOGICAL DEFENSE RESEARCH

a. Basic Research in Life Sciences. Program Element (PE) 61102. Project A71A

The objective of this program is to support the Biological Defense Program and to maintain a technology base for nonmedical aspects of biological defense. Effort is also directed toward the appraisal of new concepts for the rapid detection, identification, and decontamination of and protection from biological threat agents.

During FY 90:

Purified and isolated a catalytic, bacterial enzyme which detoxifies some threat agents.

Isolated bacterial cultures which will grow on hydrolyzed mustard and could be used as both a source of decontaminating enzymes as well as for the demilitarization of mustard stockpiles.

Demonstrated the ability of biosurfactants to solubilize poorly soluble organic compounds; e.g. chemical agents, by using a microbially produced biosurfactant to support next- or future-generation decontamination methods.

Developed expertise and established the foundation of an experimental database for the application of laser Raman spectroscopy to study interactions of toxins with bio-receptors (regulators of bodily functions) in support of threat agent detection.

Designed mass spectrometric studies of peptides using laser desorption and ionization techniques for future development of mass spectrometers optimized for biological detection.

Isolated a lectin responsible for pathogenicity and monoclonal antibodies which target pathogenic potential. This capability has been converted into a practical test using microsphere technology which will be used in pathogen detection.

b. Medical Biological Defense. PE 61102. Project BS12

Basic Research

The objectives of the medical research efforts are to define the basic mechanisms of action and physiological effects of low molecular weight peptides and toxins; to determine the physicochemical nature of toxins of biological origin; to develop the medical technological base to counteract the threat posed by known or newly discovered agents of biological origin (toxins, bacteria, rickettsia, or viruses); and to exploit existing and new technologies for the development of generic drugs, vaccines, or other therapeutic and prophylactic measures against these potential agents. This effort provides the basic scientific information necessary for the development of improved systems for the medical diagnosis, treatment, and prevention of biological agent casualties.

During FY 90:

Studied the molecular basis of virulence of Bacillus anthracis (anthrax bacterium) and found that certain genes are potentially significant for the expression of virulence; therefore, they are critical in the development of an anthrax vaccine.

Produced a protective monoclonal antibody against the receptor of diphtheria toxin and demonstrated that toxicity of tetanus toxin is reduced by drugs that increase intracellular metabolism. These findings will be used as laboratory simulants for the study of botulinum neurotoxins.

Demonstrated an antiviral drug which prevents death of cells due to poisoning by ricin (potent biotoxin from castor bean seeds) and other analogous biological toxins. This represents significant progress toward a specific therapy for potentially lethal poisoning from this type of toxin.

Demonstrated for the first time that tetrodotoxin (puffer fish neurotoxin), once thought to act only on peripheral nerves, also has direct effects on brain respiratory centers, a finding which will enhance efforts to produce new medical countermeasures against this type of potential biological threat.

Demonstrated, by antigenic analysis of Crimean-Congo hemorrhagic fever (CCHF) virus with monoclonal antibodies, that the diagnostic antigen of choice is the internal nucleocapsid antigen, and that the antigen capable of inducing an efficient protective immune response resides on the G2 glycoprotein, thus serving as a possible vaccine.

Created a live, attenuated Venezuelan equine encephalitis vaccine using recombinant

deoxyribonucleic acid (DNA) technology which resulted in three attenuating mutations which appear to be highly attenuated in a model system and provide solid immunity to challenge with a virulent strain.

Demonstrated a drug which reduces the number of cellular binding sites for T-2 mycotoxin (fungal biotoxin) and protects cells from its deleterious effects.

Established procedures for purifying milligram amounts of undenatured CCHF viral glycoproteins for use as antigen in the generation of human monoclonal antibodies.

Developed vaccinia virus vectors for expression of Hantaan virus genes to be used for experimental human vaccines against hemorrhagic fever with renal syndrome (HFRS).

Developed a model for testing experimental vaccines against HFRS, and elucidating antigen distribution and serological responses.

Found a surface peptide of vaccinia virus that may be a particularly relevant target of humoral immunity because monoclonal antibodies to this protein neutralize the virus in vitro, protects from lethal challenge, and restricts the replication and immunogenicity of the virus in vivo.

Investigated mechanisms of vaccinia virus neutralization, and discovered that the most potent neutralizing monoclonal antibodies act after the virus attaches to cells.

Identified albumin as a potentially effective carrier vector for crossing the blood brain barrier, since it is non-toxic, non-immunogenic and, most importantly, has favorable pharmacokinetics.

Established an in vitro viral infection model using human white blood cells (monocytes), which quantifies viral replication by several techniques, establishes standard protocols for infection, assesses macrophage viability, and quantifies virus.

c. Exploratory Development, PE 62622, Project A553 and PE 62786, Project AH98

The objective of this program is to support development of nonmedical defensive materiel against biological agents directed toward the appraisal of new concepts for the rapid detection, identification, decontamination and physical protection of/from biological threat

agents.

During FY 90

Updated an assessment of the biological agent challenge produced by potential threat delivery systems.

Incorporated Light Addressable Potentiometric Sensor technology into the development of breadboard models of the Bio-Chemical Detector for detection of biological warfare threat agents.

Fabricated a breadboard Chemical/Biological Mass Spectrometer (CBMS) unit under the CBMS exploratory development contract.

Expanded a data base of mass spectra of biological samples.

Determined the optimal classes of agents of biological origin (ABO) for testing individual protective equipment and formulated the ABO/Aerosol Test Program.

2. DEFENSIVE SYSTEMS

a. Exploratory Development, PE 62770, Project A871

The objectives of the exploratory development project are to develop safe and effective vaccines/toxoids against agents of biological origin that are potential threats; to develop novel anti-agent drugs by identifying potential targets for pharmacological intervention; to develop generic anti-agent drugs that have a broad spectrum of activity and are effective against entire classes of toxins or organisms; to investigate molecular and biological properties of agents and to identify characteristics useful for diagnosis, prophylaxis and therapy of associated diseases; to elucidate their pathogenesis of infections or intoxications induced with experimental aerosols to determine the sequence of events leading to protective immunity; to exploit biotechnological approaches to produce more effective and broad-spectrum vaccines; and to develop improved methods and technologies for rapid diagnosis and identification of biological agents.

During FY 90:

Compared the effectiveness of various combinations of anthrax vaccine candidates and adjuvants, and found that the protective antigen (PA) component of anthrax toxin in combination with one particular adjuvant gave almost 100% better protection than the existing vaccine.

Generated monoclonal antibodies to the polysaccharide cell wall of Bacillus anthracis, and used these antibodies to develop a fluorescent antibody assay for B. anthracis, which has been employed in several laboratories to investigate recent anthrax outbreaks in the U.S. and Canada.

Produced gene probes for identification of staphylococcal biotoxins, and showed them to be sensitive and reliable for diagnosis, differentiation, and characterization of toxinogenic Staphylococcus aureus strains.

Demonstrated protection from the lethal effects of inhaled ricin (potent biotoxin from castor bean seeds) by both passive and active systemic immunization, but found that immunization did not fully protect against pulmonary damage.

Discovered a key cell biochemical pathway which is affected by staphylococcal enterotoxin B. This study shows potential therapeutic approaches for treatment of military personnel exposed to this threat agent.

Generated monoclonal antibodies to a Yersinia pestis (plague) antigen for use in field diagnostic and identification assays.

Verified, during a collaborative effort, that a reverse-osmosis pump removed 99.9% of ricin (potent biotoxin from castor bean seeds) saxitoxin (marine dinoflagellate biotoxin), microcystin (algal hepatotoxin), and/or T-2 mycotoxin (fungal biotoxin) from drinking water.

Established and optimized monoclonal antibody-based enzyme-linked immunosorbent assays (ELISAs) to identify snake neurotoxins in clinical samples.

Obtained data supporting the hypothesis that saxitoxin (marine dinoflagellate biotoxin) crosses the blood-brain barrier; therefore, direct central respiratory effects must be considered in any therapeutic approach.

Continued work on synthesis of tetrodotoxin (puffer fish biotoxin) for potential vaccines and on generation of tetrodotoxin monoclonal antibodies.

Identified a component in serum that rapidly cleaves the higher molecular weight form of the protective antigen (PA) component of anthrax toxin to its lower molecular weight, active form, and identified the lower molecular weight form in laboratory models; thus confirming previous in vitro data suggesting that the PA must be activated by cleavage prior to binding of the other anthrax toxic components.

Investigated the use of the PA component of anthrax toxin in several candidate vaccine vectors (carriers) and found that PA produced by cloning in baculovirus conferred complete protection to a virulent spore challenge in a laboratory model, whereas live vaccinia virus containing the cloned gene for PA provided only partial protection.

Evaluated potential antiviral drugs active against Ebola virus under Biological Safety Level 4 laboratory containment conditions. This study was prompted by recognition of Ebola-like virus in non-human primates imported into the U.S.

Initiated development of specific polymerase chain reaction (PCR) probes (ribonucleic acid sequences) for the differential identification of simian hemorrhagic fever and Ebola viruses.

Conducted primary in vitro testing on candidate antiviral compounds with the automated enzymatic assay against militarily relevant viruses or their laboratory simulant, and found numerous reactive compounds which may have potential as antiviral drugs.

Initiated efforts to transform murine monoclonal antibodies to Junin and vaccinia viruses into human-type antibodies. Immunotherapy with homologous antibody is expected to be more effective than comparable treatment with antibody from a different species.

Found that complete protection against a phlebovirus aerosol challenge can be provided by intraperitoneal primary immunization followed by intranasal secondary immunization, whereas only 50-60% protection is achieved by conventional immunization procedures.

Industrial Base for Biological Defensive Systems

b. Advanced Development.

CB Defense Systems Advanced Technology.

The objective is to conduct Advanced Technology Transition Demonstrations (ATTDs) of technologies and materiel in support of deterrence and defense against chemical and biological warfare as well as ATTDs for equipment defeating munitions. The Army is the DOD Executive Agent for Chemical Warfare (CW) and Chemical and Biological Defense (CBD) research. ATTDs are conducted in an operational environment with active user and developer participation and demonstrate capabilities to integrate diverse technologies to improve DOD CW deterrence and CB Defense. ATTDs will speed maturing of advanced technologies and reduce risk in the development programs of next generation and future systems.

During FY 90:

Chemical/Biological Mass Spectrometer: PE 63759, Project DE83

The objective is to demonstrate the ability of a prototype mass spectrometer to detect, identify and determine semi-quantitative concentrations of chemical and biological agents present in ambient air as vapor, aerosol, or liquid droplets. This ATTD involves the design, development and demonstration of a sampling front end, a pyrolysis subsystem for biological particle sample dissociation and introduction, a small mass analyzer, and algorithms for rapid analysis of mass spectra. The CB Mass Spectrometer (CBMS) will be a fully automatic, multipurpose point detection and identification system capable of detecting known and unknown CB agents. The CBMS will be a component of the NBC Reconnaissance System and a component of the Fixed Site Detection and Warning System. It will be modular to accommodate future advances in hardware technology and changes in the CB threat. Key technologies include quadropole ion storage, multistage impaction, infrared pyrolysis, and artificial intelligence.

During FY 90:

Fabricated an additional breadboard unit under the CBMS exploratory development contract for ATTD testing.

Bio-Chemical (BC) Detector: PE 63759, Project DE83

The objective is to demonstrate a full-up working prototype of the BC Detector, the first unit issue biodetection capability within NATO. Since the BC Detector is based on high risk,

state-of-the-art technology, this demonstration will significantly reduce the risk associated with development of the concept model required in the Proof of Principle phase. The BC Detector is a hand-carried, automatic, point sampling alarm for detecting chemical and biological warfare agents. The alarm will have the capability to classify and to semi-quantitate nerve, blister, blood toxin, and pathogen agents. The system will be modular in nature to allow for upgrade in anticipation of advances in technology or changes in the CB threat. The Pre-planned Product Improvement program will add a capability for generic detection of all agents. Key technologies include Ion Mobility Spectrometry; biotechnology (monoclonal antibodies, receptor sites, and automated antibody immunoassay); miniaturized aerosol sampling (virtual impaction); biosensors (Light Addressable Potentiometric System) and transputers. The BC Detector will ultimately replace all field detectors in the Unit Detection and Warning System. It will also provide future generic detection of all CB agents and possible replacement of the Automatic Chemical Agent Alarm on the NBC Reconnaissance System and Heavy Force Modernization.

During FY 90:

Fabricated breadboard models of the BC Detector in a configuration that could be easily tested outside of a laboratory.

Planned for and initiated in-house testing with biological simulants.

Nonsystems, PE 63002, Project D807

The objectives of this project are to develop the laboratory methodologies necessary for pilot production of vaccines; to compare production methods to reduce production risks; to prepare initial large standard lots of drugs and vaccines against biological agents which are required to initiate a wide array of safety and efficacy laboratory studies necessary for regulatory approval; to perform requisite preclinical testing of drugs and vaccines necessary for their development into products usable in humans; and to develop, test, and perfect methods for rapid identification of potential biological agents.

During FY 90:

Evaluated the safety and protective efficacy of recombinant Venezuelan equine encephalitis (VEE) vaccine candidates and found that a triple-mutation vaccine induced protective immunity to challenge with virulent strains of VEE virus.

Initiated synthesis of ricin peptides for use in immunization studies, as well as in efforts to develop monoclonal antibodies against ricin. Obtained 100% protection using a ricin toxoid in a model system against a lethal exposure.

Demonstrated the protective efficacy of the lipopolysaccharide from phase I Coxiella burnetii (Q fever) in a laboratory, and determined that the protection afforded by the lipopolysaccharide may be due in part to the presence of co-extracted peptides.

Demonstrated protection from a lethal ricin (potent biotoxin from castor bean seed) aerosol exposure in a model system by passive administration of purified goat antibody, and produced fragments of anti-ricin goat polyclonal antibody for prophylaxis studies involving aerosolized and intravenous ricin.

Identified a protein antigen encoded by a gene of Coxiella burnetii and found that the protein was immunogenic, elicited specific antibodies, and may be useful in the detection and characterization of Q fever disease progression.

Developed two new direct competitive inhibition enzyme immunosorbent assays for palytoxin (soft coral biotoxin).

Documented the outbreak of Nephropathia epidemica disease, a viral hemorrhagic fever, among U.S. military participants in Reforger exercises in Europe during January-February 1990. This was the first recognition of an outbreak of this disease among U.S. forces in Europe.

Found that both alpha and gamma interferon demonstrated an antiviral effect in vitro in Junin virus-infected human macrophages.

Applied polymerase chain reaction (PCR) technology for diagnosis and identification of new isolates of Ebola virus obtained during a recent outbreak of disease in monkeys housed in a commercial facility.

Developed and validated an Ebola virus antigen diagnostic assay which allows rapid (3 hours or less) identification of viral antigen in tissues or serum. A patent application is pending, and the assay will serve as the basis for a collaboration with the Centers for Disease Control for epidemiological decisions on the importation of non-human primates into the U.S.

Developed drug evaluation models for compounds active against Hantaan virus which represents significant improvement over a previous model.

Completed a study of the pathogenesis of an encephalitis virus in a model to define histologic and biochemical markers for in vitro testing of antiviral compounds.

Compared ribavirin analogs in laboratory models to select the best candidate for development of oral prophylaxis of viral infections and discovered no significant difference in antiviral activity.

Determined that combinations of ribavirin or ribamidine with immunomodulators produced synergistic increases in antiviral activity in a virus model.

Drug and Vaccine Development, PE 63807, Project D809

The objectives of this project are to develop feasible methodologies for production of drugs and vaccines to be used in protection and therapy against biological agents; to prepare pilot quantities of specific vaccines for human safety and efficacy testing; to conduct phase I and phase II clinical trials of drugs and vaccines developed for protection and therapy; and to develop prototype rapid identification and diagnostic systems to be used in the identification of biological agents in clinical samples.

During FY 90:

Completed phase I clinical testing of Tularemia vaccine.

Initiated preclinical studies of Type F botulinal toxoid for use in protecting soldiers from this biotoxin.

Submitted an Investigational New Drug Application for a new Q fever vaccine.

Transitioned the oral antiviral drug, ribavirin, to full-scale development.

Developed a cell culture-propagated smallpox (vaccinia virus) vaccine.

Continued evaluation of three nondevelopmental item formats of a rapid, field identification system for bacteria and viruses of military relevance.

Obtained approval of a clinical protocol to provide the Chikungunya vaccine to at-risk laboratory workers.

Initiated a clinical protocol to examine the potential interference in sequential administration of the live, attenuated alphavirus vaccines for Chikungunya and Venezuelan equine encephalitis.

Completed studies to define the ability of mosquitoes to become infected and transmit the parent and vaccine strains of Chikungunya after feeding on vaccine recipients, and found that it is extremely unlikely that Chikungunya vaccine would be transmitted by mosquito vectors to other individuals. Determined that no human studies on this question are required.

c. Full-scale Development, PE 64807, Project D847

The objectives of this project are to standardize upon a single major production process adequate to produce substantial, sufficient amounts of a specific vaccine or drug to perform clinical (field) trials; to conduct clinical trials of drugs or vaccines for protection and therapy against biological agents; and to standardize a production process for a specific system for rapid identification and diagnosis of biological agents in clinical specimens.

During FY 90:

Expanded the Argentine hemorrhagic fever live vaccine field trial to 6,500 volunteers.

Initiated a new production lot of Eastern Equine Encephalitis vaccine.

Completed a clinical report on placebo-controlled double-blind trial of intravenous ribavirin against hemorrhagic fever with renal syndrome (HFRS). This study showed efficacy and will be used for submission of a New Drug Application for this indication.

Continued review of safety data on intravenous ribavirin used in therapeutic trials against Lassa fever conducted by the Centers for Disease Control.

Continued support of a production facility for experimental vaccines, monoclonal antibodies, and other non-commercial research and diagnostic reagents that require specialized biocontainment facilities for their production.

d. Testing

No obligations were incurred.

3. SIMULANT TEST SUPPORT

No obligations were incurred.

4. MANAGEMENT AND SUPPORT.

The objectives of this program are to provide maintenance support of laboratories; to conduct studies and analyses in support of research and development programs; and to support military construction of research, development, test and evaluation facilities.

During FY 90:

No obligations were incurred.

ANNEX B

DEPARTMENT OF THE NAVY

ANNUAL REPORT ON

CHEMICAL WARFARE - BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS

1 OCTOBER 1989 THROUGH SEPTEMBER 1990

RCS: DD-DDR&E(A) 1065

OBLIGATION REPORT OF RESEARCH, DEVELOPMENT,
TEST AND EVALUATION FUNDS FOR THE PERIOD
1 OCTOBER 1989 THROUGH 30 SEPTEMBER 1990
REPORTING SERVICE: DEPARTMENT OF THE NAVY
RCS: DD-R&E(A)1065(7040)

DESCRIPTION OF RDTE EFFORT FOR THE CHEMICAL WARFARE AND BIOLOGICAL DEFENSE PROGRAM

During FY90, the Department of the Navy obligated $19,528,000 for general research investigations, development and test of chemical warfare agents, weapon systems and defensive equipment.

FUNDS OBLIGATED
($000)

Current Fiscal Year	FY90$	19,528		
Prior Year	FY89	250		
			In-House $	10,783
TOTAL	$	19,778	Contract $	9,170

Breakdown of Program Areas

1. CHEMICAL WARFARE PROGRAM

a. Defensive Equipment Program	FY90	$ 19,528		
	FY89	250		
			In-House $	10,7837
TOTAL		$ 19,778	Contract $	9,170

(1) Chemical Research	FY90	$	2,809		
	FY89		0		
				In-House $	1,540
TOTAL		$	2,809	Contract $	1,269
(2) Exploratory Development	FY90	$	3,884		
	FY89		0		
				In-House $	2,294
TOTAL		$	3,884	Contract $	1,590
(3) Advanced Development	FY90	$	6,390		
	FY89		90		
				In-House $	2,807
TOTAL		$	6,480	Contract $	3,848
(4) Engineering Development	FY90	$	6,445		
	FY89		160		
				In-House $	4,142
TOTAL		$	6,605	Contract $	2,463
b. Offensive Equipment Program	FY90	$	0		
	FY89		0		
				In-House $	0
TOTAL		$	0	Contract $	0
(1) Chemical Research	FY90	$	0		
	FY89		0		
				In-House $	0
TOTAL		$	0	Contract $	0

(2) Exploratory Development	FY90	$	0		
	FY89		0		
				In-House $	0
TOTAL		$	0	Contract $	0
(3) Advanced Development	FY90	$	0		
	FY89		0		
				In-House $	0
TOTAL		$	0	Contract $	0
(4) Engineering Development	FY90	$	0		
	FY89		0		
				In-House $	0
TOTAL		$	0	Contract $	0
2. BIOLOGICAL RESEARCH PROGRAM					
a. Defensive Equipment Program	FY90	$	0		
	FY89		0		
				In-House $	0
TOTAL		$	0	Contract $	0
(1) Biological Research	FY90	$	0		
	FY89		0		
				In-House $	0
TOTAL		$	0	Contract $	0
3. ORDNANCE PROGRAM	FY90	$	0		
	FY89		0		
				In-House $	0
TOTAL		$	0	Contract $	0

EXPLANATION OF OBLIGATIONS

CHEMICAL RESEARCH

Funding supports:

- Additional testing, designated Operational Testing IIC (OT-IIC), mandated by the FY 1989 DOD Authorization Act. Funds were allocated to the Army for implementation of BIGEYE OT-IIC support tasks. Such testing has since been cancelled per SEC DEF direction.

- Basic research into the chemistry of sensing and destroying threat agents.

- Development of a collective protection system against chemical and biological addition to filtration and active filtration systems in which it is necessary to explore the usefulness of systems in which incoming air is scrubbed by an electrical discharge.

- Development and optimization of new ionization techniques in mass spectrometry which will permit sensitive and selective analysis of saxitoxins and blue-green algal toxins.

a. EXPLORATORY DEVELOPMENT

Funding supports:

(1) The United States Navy's Chemical and Biological (CB) Program;

- Evaluation of the performance effect of acute and chronic exposure to chemical agents and defense drugs (pyridostigime and valium).

- Threat and technology interface.

- Evaluation of wind-driven aerosol penetration of Navy chemical protective

overgarments (CPO).

- Measuring and predicting sorption of vapors into sensor coating materials.

- Chemiresistor device for detecting CW agent vapors.

- Development of a new reactive sorbent for CW agent filtration.

- Capability assessment of forces afloat to detect a CB threat, perform decontamination and survive in an NBC environment.

- Battle area dense gas modeling for the U.S. Navy.

- Research into the degradation of filtration carbon by weathering in a Naval environment.

- Development and evaluation of catalytic and catalytic oxidation methods for air purification with emphasis on halocarbons.

- Research into aerosol scrubbers for the development of airlocks to provide a passageway between a contamination hazard area and a contamination free area.

(2) The United States Marines' CB program;

- Decontamination technology, less corrosive supportable materials.

- Lightweight integration suit technology.

- Physical protection technology, research into the M40 respirators liquid agent resistance, improved voice communications and reduced size and weight of the mask.

- Detection technology to include improved standoff chemical detection capability and point detector sensors.

- Advanced filtration technology, research into new filter materials and canister design concepts for air/ground crews.

- CB defense of amphibious vehicles, to include the development of hybrid collective protection concepts and PSA. Development of CB survivability criteria for amphibious vehicles.

b. ADVANCED DEVELOPMENT

(1) Ship Combat Survivability. Program Element (PE) 63514N, Project S2053

Funds support advanced development for defense of Navy and Marine Corps personnel and equipment afloat and ashore against chemical and biological agents. This program includes defense of ships, aircraft ground crew and overseas shore bases. The funded areas of development are detection, collective protection, personnel protection and decontamination.

(2) Aircrew Systems Development. PE 64264N, Project W0606

Funding also supports engineering development of Aircrew Eye/Respiratory Program. This entails demonstrating that the design meets specifications in performance, reliability, maintainability, survivability, and system safety, prior to the first major production decision.

Advanced development of the collective protection system against chemical and biological agents is being pursued and different systems for scrubbing air streams are being sought. Development of optimization and new ionization techniques in mass spectrometry are also included in this program. Funding also went to the development of the Detection and Warning System and the Individual Protection programs. Each contains subsets requiring extensive research.

c. ENGINEERING DEVELOPMENT

Chemical Warfare Counter Measures. PE 64506N, Project S0410

Funds support development of equipment and procedures that will provide effective NBC Defense in a hostile environment. This develops protective clothing that minimizes degradation of personal performance due to heat stress. It is also developing citadel areas for collective protection designed for new ships or backfit in selected compartments. Two basic types of detectors are being developed: long range, early-warning and point-detectors which locate and identify local/surface contamination. Decontamination processes, substances and equipment will be provided to remove contaminants or detoxify personnel and material. Combinations of the products from these four areas provide systems for NBC Defense. This program also supports engineering development of a collective protection system, systems for scrubbing air streams, and optimization of new ionization techniques in mass spectrometry.

ANNEX C

DEPARTMENT OF THE AIR FORCE

ANNUAL REPORT ON

CHEMICAL WARFARE - BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS

1 OCTOBER 1989 THROUGH SEPTEMBER 1990

RCS: DD-DDR&E(A) 1065

OBLIGATION REPORT OF RESEARCH, DEVELOPMENT,
TEST AND EVALUATION FUNDS FOR THE PERIOD
1 OCTOBER 1989 THROUGH SEPTEMBER 1990
REPORTING SERVICE: DEPARTMENT OF THE AIR FORCE
RCS: DD-R&E(A)1065(7040)

DESCRIPTION OF RDT&E EFFORT FOR THE CHEMICAL WARFARE PROGRAM

During FY90, the Department of the Air Force obligated $13,334,000 for general research investigations, development and test of chemical warfare defensive equipment.

		FUNDS OBLIGATED ($000)	
Current Fiscal Year	(CFY)	$ 6,694	
Prior Year	(PY)	6,640	
TOTAL		$ 13,334	In-House $ 3,731 Contract $ 9,603

Breakdown of Program Areas

1. CHEMICAL WARFARE PROGRAM

a. Defensive Equipment Program	CFY PY	$ 6,694 6,640	In-House $ 3,731 Contract $ 9,603
Total		$ 13,334	
(1) Basic Research		None.	

(2) Exploratory Development	CFY PY	$ 2,645 $ 12	In-House $ Contract $	0,654 2,003
Total		$ 2,657		
(3) Advanced Development	CFY PY	$ 0 $ 0	In-House $ Contract $	0 0
Total		$ 0		
(4) Engineering Development	CFY PY	$ 4,049 $ 6,628	In-House $ Contract $	3,077 7,600
Total		$ 10,677		

b. Offensive Equipment Program — None.

2. BIOLOGICAL DEFENSE RESEARCH PROGRAM — None.

EXPLANATION OF OBLIGATIONS

Chemical Warfare Program

Defensive Equipment Program

a. Basic Research

Basic research in chemical defense is performed by the Army for the Air Force.

b. Exploratory Development

Aerospace Biotechnology: Program Element (PE) 62202F

This program is evaluating new technology for aircraft and shelter detection to monitor toxic safe and entry areas, decontamination of aircraft used in Mobile Forces operations, improvements in Individual Protective Equipment, heat stress basic studies, mobile shelters for Deployable Forces and system analysis, studies to determine impact of equipment development on sortie generation.

c. Advanced Development

None.

d. Engineering Development

(1) Chemical/Biological Defense Equipment; Individual Protection. PE 64601F, Project 3337

The Aircrew Eye-Respiratory Protection (AERP) system completed engineering development flight testing for the MH-53, C-130, and C-9. Flight testing of the AERP system in the F-16 and AC-130 aircraft was initiated. With the initiation of Operation Desert Shield, HQ TAC elected to use the filter-blower variant of the AERP system and efforts were initiated to qualify the motorblower for C-9 operation. A contractor survey and evaluation of commercially available disposable masks was completed. A contractor evaluation of chemically protective fabrics for possible use in a lightweight, reduced thermal burden ensemble for ground crew personnel was completed. The final report is still in preparation.

(2) Chemical/Biological Defense Equipment; Collective Protection. PE 64601F, Project 3762

Live agent testing of a commercial Pressure Swing Adsorption (PSA) system was completed. The system performed well. The Transportable Collective Protection System is still undergoing development and operational testing.

(3) Chemical/Biological Defense Equipment; Decontamination. PE 64601F, Project 3764

Support continued on an Army development of a non-aqueous decontamination system for avionics equipment.

(4) Chemical/Biological Defense Equipment; Detection and Warning. PE 64601F, Project 3321

Development of threat scenarios and engineering support for the Fixed Site Detection and Warning System continued.